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A comparative study of oral health attitudes and behavior using the Hiroshima University - Dental Behavioral Inventory (HU-DBI) between dental and civil engineering students in Colombia

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Abstract

The aim of this study was to use the Hiroshima University - Dental Behavioral Inventory (HU-DBI) to compare oral health attitudes and behavior of dental and civil engineering students in Colombia. The HU-DBI's survey consisting of twenty dichotomous responses (agree-disagree) regarding tooth brushing, was completed at University Antonio Narino for the dental students and the University of Cauca for the civil engineering students. The Spanish version of the HU-DBI questionnaire was taken by 182 of 247 dental students and 411 of 762 engineering students. The data was-statistically analyzed by the chi-square test and backward logistic regression. Compared to the engineering students, the dental students were more likely to agree with questions such as “I am bothered by the color of my gums”(OR = 2.2, 95% CI: 1.3-3.7),“I think I can clean my teeth well without using toothpaste” (OR = 3.0, 95% CI: 1.5-5.9), “I have used a dye to see how clean my teeth are” (OR = 2.9, 95% CI: 1.9-4.3), and “I have had my dentist tell me that I brush very well” (OR = 2.0, 95% CI: 1.3-3.1). The dental education curriculum in a dental school compared to a civil engineering school in Colombia indicated that a three-phase curriculum in didactics and clinics increased oral health attitudes and behavior from entry to graduation.

Keywords

oral health; behavior; tooth brushing; dental students; dental school curriculum; Colombia

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Introduction

Dental students are the future leaders in oral health care and are expected to be teachers of oral hygiene as well as role models of self-care regimens for their patients as their dental education progresses. In a dental school setting, it is critical to evaluate yearly progress of dental students learning about self-care regimens such as oral health attitudes and behavior. However, little attention has been paid to annual progress due to the difficulty of outcomes measurement and lack of control group students outside the dental school. Therefore, the current problem is the difficulty of examining how dental education helps to shape oral health attitudes and behavior for dental students in comparison to non-dental students.

It is known that in the complex interplay of factors that shape attitudes and health behaviors, two major influences have been identified: one is learned experience and the other is culturally determined attitudes/beliefs/behaviors (social norms) (1,2). In the context of the oral health attitudes and behaviors of students, learned experience is equated with dental education and its curriculum, while social norms are established and reinforced by non-dental education. However, the impact of learned experience on top of baseline values such as social norms is unknown in the dental education setting.

To answer this research question, we administered the Hiroshima University - Dental Behavioral Inventory (HU-DBI) to Colombian dental students as the experimental group and civil engineering students as the control group, since civil engineering is also a five-year program with excellent students having an academic level similar to that of the dental students. The HU-DBI, developed by Kawamura, consists of twenty questions eliciting dichotomous responses (agree/disagree) to examine oral health attitudes and behavior of patients during tooth brushing. The HU-DBI has good test/retest reliability, and thus, it is not only useful for understanding patients but also for predicting clinical outcomes (3,4). In addition, the HU-DBI has been translated from Japanese into English, Finnish, Chinese, and Korean for cross-cultural comparisons. Results for these translated versions, including methods and reliability, have been reported previously (5-8).

The aim of this study was to compare the oral health attitudes and behavior of dental and civil engineering students in Colombia using the HU-DBI.

Materials and Methods

At the time of implementation, no Spanish translation of the HU-DBI was available. The translation from Japanese into Spanish was conducted in two phases. A Spanish version of the HU-DBI was made from the Japanese version using a translation procedure led by Spanish and Japanese bilingual experts having experience with questionnaires and survey research. Back-translation was used during this translation process. Sixteen Spanish and Japanese bilingual individuals were invited to take both Spanish and Japanese versions of the HU-DBI. They were asked to answer each version of the questionnaire separately at different times (3-6 hours apart). The reliability of the translated version was measured using Spearman's rank correlation. The co-relation between the Spanish and Japanese

versions measured by Spearman's rank correlation was r = 0.973 (n = 16, P < 0.001), suggesting that the Spanish HU-DBI would be acceptable for this study.

All undergraduate dental students at University Antonio Narino (Popayan, Colombia) and civil engineering students at the University of Cauca (Popayan, Colombia) were invited to participate in this survey at the beginning of the academic year using the Spanish version of the HU-DBI questionnaire. The students were asked by their professors to remain in class at the end of a lecture to participate in this survey on a voluntary basis. No attempt was made to follow up with students who were absent on the day of the survey. Before the survey was given out, informed consent was received from those students who volunteered to take the survey. The HU-DBI questionnaire, which consists of twenty dichotomous responses (agree-disagree) regarding oral health attitudes and behavior of patients toward tooth brushing, was distributed to all students. They were asked to fill in the questionnaire and the completed questionnaires were collected. In all, 182 of 247 (73.7%) dental and 411 of 762 (53.9%) civil engineering students answered the Spanish versions of the HU-DBI questionnaire (response rates) (Table 1).

For the statistical analysis, the rate of “agree” responses was computed for dental and civil engineering students on each question during 10 semesters. Univariate logistic regression was used to investigate if there were significant differences between the dental and civil engineering students on the rate of “agree” responses controlling the effect of semesters attended for each question. The odds ratios were computed along with the 95% confidence intervals. For the multivariable analysis, backward logistic regression analysis was performed to identify significant independent questions that could differentiate the two groups of students. We used “dental/civil engineering students” as a dependent variable in the backward logistic regression to identify significant independent oral health behavior questions associated with the type of students. The effect of semester on oral behaviors was separately tested for dental and civil engineering students. All the models were adjusted for level of education (semester). The analyses were performed with SAS 9.2 (SAS Institute Inc., Cary, NC, USA).

Results

Table 2 shows the logistic regression analysis for each HU-DBI question to compare the percentage of “agree” responses between the dental and civil engineering students taking into account the effect of semesters. Compared to the civil engineering students, the dental students were more likely to agree on questions #7, #11, #16, and #20 and less likely to agree on questions # 8, #10, #14, #15, #17, and #18 after controlling the effect of semesters attended. The interpretation of the odds ratio was, for example, that the dental students were 2.77 times more likely to agree on questions #20 after controlling the effect of semesters attended compared to the civil engineering students.

Table 3 shows the estimated coefficient and related statistics from the backward logistic regression model. Backward logistic regression was used to assess whether civil and dental students have similar oral health behaviors taking into account the effect of semesters attended. As a result, compared to the civil engineering students, the dental students were

more likely to agree on questions #7, #11, #16, and #20 and less likely to agree on questions #3, #8, and #17 after controlling the effect of semesters attended. The interpretation of the odds ratio was, for instance, that the dental students were 2.05 times more likely to agree on question #20 compared to the civil engineering students after controlling the effect of semesters attended.

The effect of semester on oral behaviors was tested for dental and civil engineering students. For civil engineering students, there was no significant semester effect on any of the questions. For dental students, there were significant decreases in “agree” response in questions #1 ($P = 0.018$), #17 ($P = 0.043$), and #18 ($P = 0.004$) as semester increases. There were significant increases in “agree” response in questions #7 ($P = 0.046$), #9 ($P = 0.043$), and #11 ($P = 0.010$) as semester increases. At semester 1, there was no significant difference between dental and civil engineering students in all questions except for question #4. Dental students were less likely to agree on question #4 as compared to civil students ($P = 0.021$).

Discussion

This study investigated the impact of learned experience (i.e., dental education programs) on attitudes toward and behavior promoting oral health in the Republic of Colombia. Currently, the Colombian population suffers from limited access to information about dental care. Most dentists are concentrated in metropolitan areas, while too few practice in rural areas and small towns. Of all the Colombian cities and towns, Medellín is the only city with a continuing annual oral health prevention program based on education and fluoridated mouth rinses in public schools (9). Historically, information about oral disease prevention may not be provided by dental staff, and the risk of misinformation has been a concern (10). Students coming to dental school, especially those from outside the Medellín public school system, are unlikely to share a social norm regarding oral health since they would not have been exposed to oral health prevention programs.

To help address Colombia's oral health care needs, the country currently has twenty-one accredited dental schools (sixteen of which are private and five public). All applicants to dental school must have graduated from high school; no undergraduate pre-dental coursework is required before admission. The five-year (ten-semester) dental school program that culminates in a Doctor of Dental Surgery (D.D.S.) degree comprises two years, or four semesters, of mainly preclinical didactic and laboratory courses, and three years, or six semesters, of mainly clinical training that is supervised by the faculty members. In the fifth year (the ninth and tenth semesters), the students do rotations in hospitals and health institutions (11).

The Colombian dental school curriculum consists of three phases to teach preventive dentistry and oral health promotion. In phase I, didactic courses in cariology and epidemiology are taught in the third semester (Year 2). In phase II, clinical courses such as promotion and prevention clinic resume in the fourth semester (Year 2). In phase III, clinical courses such as integrated clinics are taught from the sixth to the tenth semesters (Years 3-5) (11).

To determine the impact of the dental curriculum, this study compared the oral health attitudes and behavior of dental and civil engineering students in Colombia using the HU-DBI. Out of the twenty questions from the HU-DBI, compared to the civil engineering students, the dental students were more likely to agree on questions such as “I am bothered by the color of my gums” (#7), “I think I can clean my teeth well without using toothpaste” (#11), “I have used a dye to see how clean my teeth are” (#16), and “I have had my dentist tell me that I brush very well” (#20). The result of #7 implies dental education influences the awareness of not only caries prevention but also periodontal disease prevention. It is assumed that the increased response to question #11 among dental students is that the students, who give toothbrushing instructions to patients in phases II and III, have developed an understanding that the mechanical removal of dental plaque does not depend only on toothpaste use. Based on logistic regression, it is speculated that these results can be attributed to the formal dental education (i.e., preventative dentistry and oral hygiene courses) the students received as opposed to individual predilection for such behavior. Dental students can also be assumed to have been concerned about tooth care before entering their dental programs.

On the other side of the spectrum, compared to civil engineering students, dental students were less likely to agree on questions like, “I worry about the color of my teeth” (#3), “I think my teeth are getting worse despite my daily brushing” (#8), and “I use a toothbrush which has hard bristles” (#17). Dental students were half as likely to agree with civil engineering students on question #17, which might be due to a stereotypical opinion that hard-bristled brushes are better for brushing. Dental students were also half as likely to agree with questions #3 and #8. The dental students were likely to explore more preventative measures of oral care, which would lead to better knowledge regarding questions #3 and #8. However, caution should be exercised not to generalize the findings from one school in this study to the other schools.

A similar study using a modified HU-DBI was conducted with first-year dental and medical students who were also given the same test when they were fifth-year students at Peking University in China (12). While the changes in fifth-year dental students in comparison to the results from their first year were significant, there were no significant changes in first- and fifth-year medical student responses. From another report from 1999 that compares dental hygiene and nursing students in Japan utilizing the HU-DBI (13), the duration of education and the didactic/clinic curriculum were assumed to be the factors influencing changes in first- and last-year student responses.

In conclusion, significant dental educational outcomes were observed in comparison to those for the civil engineering students. The implications of this study for dental education include modifying dental school curricula to improve oral health attitudes and behavior of the dental students.

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Table 1

The number of enrolled and respondent students

		Civil Engineering			Dental		
	Semester	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**
Year 1	1	23 (73)	23 (39)	46 (112)	5 (8)	16 (18)	21 (26)
	2	33 (84)	19 (29)	52 (113)	10 (11)	17 (20)	27 (31)
Year 2	3	34 (69)	15 (15)	49 (84)	7 (7)	9 (12)	16 (19)
	4	19 (59)	9 (13)	28 (72)	5 (11)	10 (16)	15 (27)
Year 3	5	19 (53)	24 (19)	43 (72)	13 (13)	6 (12)	19 (25)
	6	31 (57)	20 (20)	51 (77)	5 (5)	8 (11)	13 (16)
Year 4	7	27 (35)	7 (10)	34 (45)	8 (8)	23 (26)	31 (34)
	8	24 (31)	16 (18)	40 (49)	8 (9)	13 (20)	21 (29)
Year 5	9	25 (39)	13 (19)	38 (58)	2 (7)	8 (14)	10 (21)
	10	16 (60)	14 (20)	30 (80)	6 (6)	3 (13)	14 (19)
Total		251 (560)	160 (202)	411 (762)	69 (85)	113 (162)	182 (247)

( ) the number of enrolled students

Table 2

Logistic regression analysis on each HU-DBI question to compare the percentage of "agree" response between civil engineering and dental students, controlling the effect of semesters attended

Question description	Odds ratio (95% CI)	*P* value	Semester: frequency (%) of "agree" response									
			1	2	3	4	5	6	7	8	9	10
1. I don't worry much about visiting the dentist	0.73(0.46-1.17)	0.195										
Civil Engineering			13%	15%	18%	25%	14%	27%	29%	33%	26%	7%
Dental School			19%	33%	19%	13%	21%	15%	3%	5%	20%	11%
2. My gum tends to bleed when I brush my teeth	0.87(0.55-1.35)	0.523										
Civil Engineering			20%	21%	27%	21%	23%	27%	15%	25%	18%	13%
Dental School			33%	22%	13%	27%	5%	0%	19%	24%	30%	11%
3. I worry about the color of my teeth	0.62(0.36-1.08)	0.092										
Civil Engineering			89%	88%	92%	96%	86%	88%	94%	95%	92%	77%
Dental School			76%	85%	100%	93%	89%	92%	87%	90%	100%	22%
4. I have noticed some white sticky deposits on my teeth	0.87(0.57-1.35)	0.540										
Civil Engineering			37%	19%	22%	25%	12%	18%	32%	13%	34%	27%
Dental School			5%	33%	13%	33%	16%	38%	26%	14%	30%	0%
5. I use a child sized toothbrush	1.09(0.46-2.63)	0.839										
Civil Engineering			4%	0%	6%	4%	7%	6%	3%	3%	3%	7%
Dental School			10%	4%	0%	7%	0%	8%	6%	5%	0%	0%
6. I think that I can't help having false teeth when I am old	0.68(0.41-1.14)	0.148										
Civil Engineering			13%	17%	20%	21%	21%	24%	15%	18%	8%	13%
Dental School			10%	7%	13%	7%	16%	15%	23%	5%	30%	0%
7. I'm bothered by the color of my gum	2.47(1.55-3.95)	0.0001*										
Civil Engineering			67%	73%	73%	79%	60%	69%	68%	70%	66%	73%
Dental School			52%	93%	69%	93%	100%	100%	94%	86%	90%	67%
8. I think my teeth are getting worse despite my daily brushing	0.33(0.20-0.53)	<.0001*										
Civil Engineering			24%	33%	37%	50%	23%	24%	44%	30%	21%	27%
Dental School			24%	11%	6%	7%	5%	15%	19%	14%	30%	0%
9. I brush each of my teeth carefully	1.47(0.95-2.27)	0.085										
Civil Engineering			78%	77%	78%	54%	67%	82%	74%	78%	79%	63%

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Question description	Odds ratio (95% CI)	*P* value	Semester: frequency (%) of "agree" response									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Dental School			67%	74%	75%	80%	84%	92%	84%	81%	90%	89%
10. I have never been taught professionally how to brush	0.48(0.30-0.79)	0.0033*										
Civil Engineering			15%	27%	33%	29%	21%	29%	32%	23%	13%	20%
Dental School			5%	15%	19%	7%	11%	15%	26%	14%	20%	0%
11. I think I can clean my teeth well without using toothpaste	3.15(1.72-5.74)	0.0002*										
Civil Engineering			9%	10%	2%	7%	5%	4%	9%	5%	3%	3%
Dental School			0%	15%	13%	7%	5%	31%	13%	29%	60%	0%
12. I often check my teeth in a mirror after brushing	1.46(0.97-2.19)	0.068										
Civil Engineering			74%	65%	71%	54%	67%	78%	50%	88%	61%	63%
Dental School			86%	74%	56%	93%	74%	77%	68%	71%	80%	78%
13. I worry about having bad breath	1.18(0.66-2.11)	0.586										
Civil Engineering			87%	92%	86%	93%	86%	88%	82%	90%	95%	87%
Dental School			81%	89%	88%	100%	95%	92%	94%	90%	80%	89%
14. It is impossible to prevent gum disease with toothbrushing alone	0.68(0.47-0.97)	0.0329*										
Civil Engineering			57%	56%	67%	39%	56%	53%	65%	63%	61%	57%
Dental School			48%	59%	44%	67%	37%	38%	55%	48%	40%	33%
15. I put off going to dentist until I have a toothache	0.45(0.30-0.68)	0.0001*										
Civil Engineering			26%	48%	35%	43%	40%	41%	47%	40%	32%	37%
Dental School			33%	22%	25%	20%	32%	31%	26%	14%	10%	0%
16. I have used a dye to see how clean my teeth are	3.63(2.49-5.28)	<.0001*										
Civil Engineering			35%	19%	41%	21%	37%	31%	24%	23%	16%	33%
Dental School			43%	59%	56%	73%	58%	62%	61%	62%	50%	56%
17. I use a toothbrush which has hard bristles	0.41(0.28-0.61)	<.0001*										
Civil Engineering			63%	48%	49%	46%	30%	51%	47%	53%	61%	40%
Dental School			43%	26%	38%	60%	26%	8%	10%	38%	40%	0%
18. I don't feel I have brushed well unless I brush with hard strokes	0.39(0.25-0.59)	<.0001*										
Civil Engineering			26%	46%	27%	39%	37%	41%	44%	48%	29%	43%
Dental School			38%	26%	38%	13%	16%	8%	13%	19%	0%	11%
19. I feel I sometimes take too much time to brush my teeth	1.18(0.82-1.70)	0.381										
Civil Engineering			46%	33%	41%	25%	44%	53%	29%	45%	24%	20%

Question description	Odds ratio (95% CI)	*P* value	Semester: frequency (%) of "agree" response									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Dental School			38%	33%	50%	40%	32%	38%	52%	48%	60%	11%
20. I have had my dentist tell me that I brush very well	2.77(1.91-4.02)	<.0001*										
Civil Engineering			37%	46%	22%	36%	47%	39%	32%	48%	37%	53%
Dental School			52%	48%	75%	87%	79%	38%	58%	71%	80%	67%

Table 3

Estimated coefficient and related statistics from the backward logistic regression model

Question description	Estimate	Standard Error	Wald Chi-Square	*P* value	Odds ratio (95% CI)
3. I worry about the color of my teeth	-0.333	0.157	4.501	0.034	0.51 (0.28-0.95)
7. I'm bothered by the color of my gum	0.403	0.130	9.547	0.002	2.24 (1.34-3.73)
8. I think my teeth are getting worse despite my daily brushing	-0.376	0.136	7.706	0.006	0.47 (0.28-0.80)
11. I think I can clean my teeth well without using toothpaste	0.562	0.169	10.992	0.001	3.08 (1.58-5.97)
16. I have used a dye to see how clean my teeth are	0.537	0.104	26.801	< 0.0001	2.93 (1.95-4.39)
17. I use a toothbrush which has hard bristles	-0.404	0.108	14.029	< 0.0001	0.45 (0.29-0.68)
20. I have had my dentist tell me that I brush very well	0.360	0.106	11.596	0.001	2.05 (1.36-3.11)